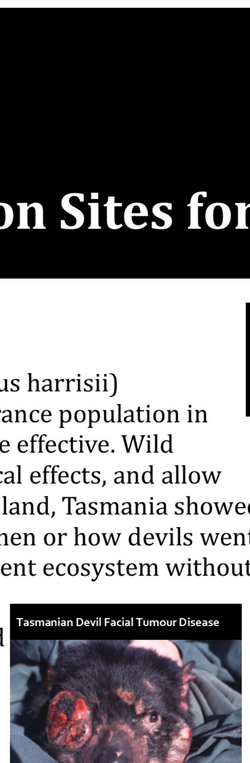
A Devil of a Job

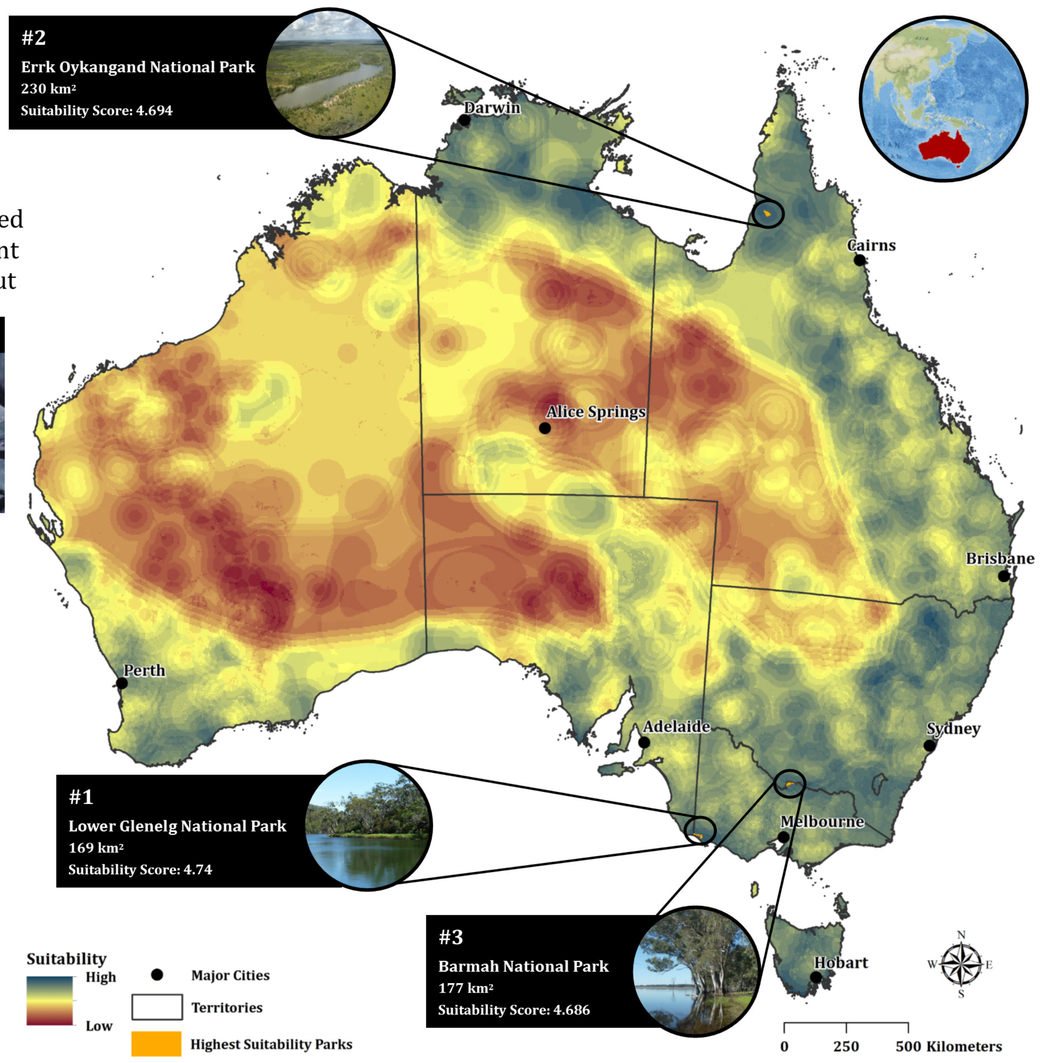
Determining Suitable Reintroduction Sites for Tasmanian Devils in Mainland Australia

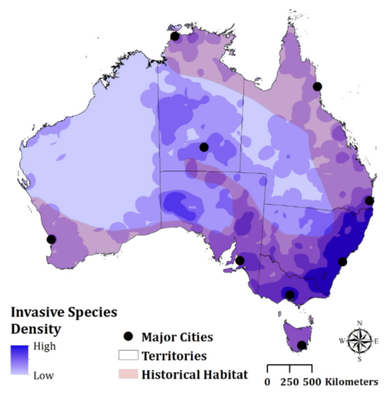
Introduction

Since the emergence of Tasmanian Devil Facial Tumour Disease (DFTD) in 1996, Tasmanian devil (Sarcophilus harrisii) populations have suffered extreme declines. While captive breeding programs have helped to create an insurance population in case of extinction in the wild, they are costly and require strenuous labor as well as careful coordination to be effective. Wild devil populations would ensure that devils retain their natural behaviors, contribute their beneficial ecological effects, and allow captive breeding programs to focus on other species in need. Relocation of a small group of devils to Maria Island, Tasmania showed evidence of the captive bred devils successfully adjusting to the wild. While there is controversy of exactly when or how devils went extinct in mainland Australia, scientists believe that it was recent enough for them to assimilate into the current ecosystem without any negative effects on native fauna and may also suppress invasive predators.

Feral cat and red fox populations have begun increasing in Tasmania in correlation with the devil decline and are also increasing in mainland Australia most likely as a result in declining dingo populations. Annual costs of foxes and cats are estimated to exceed $350 million across Australia, a large portion of that being the detrimental effects they have on biodiversity. Scientists are suggesting the reintroduction of devils to help suppress such invasive predators which are the leading cause of mammalian extinction and decline in Australia. Dingoes show evidence of fulfilling the role of a keystone predator limiting the abundance of cats and foxes, thus in their absence devils are believed to fill a similar role. This spatial analysis will determine suitable locations for the reintroduction of Tasmanian Devils to mainland Australia by considering their historical habitat, density of invasive species, habitat of threatened species, population, land use including national parks, density of dingoes, and distance from mines.



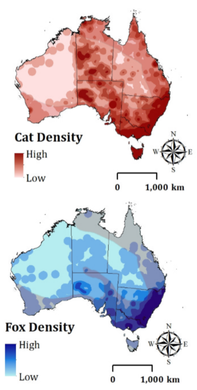


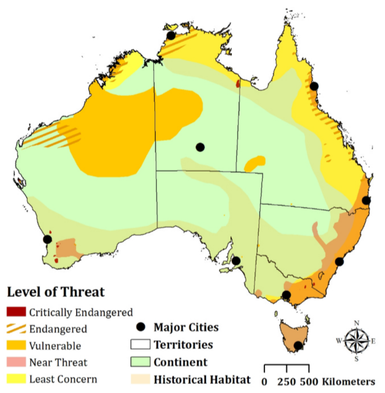


Invasive Species Density

Both red fox and feral cats are invasive to Australia and decreasing dingo populations are allowing them to thrive. The density of each was determined by using Kernel Density on population data acquired from Atlas of Living Australia. They were then reclassified and combined using Raster Calculator.

Devils are believed to help naturally control these populations through competition and intimidation. Therefore higher densities were ranked as higher suitability since devil relocation to these areas would have a positive ecological impact.





Threatened Species

Due to the high level of predation on small mammals by red fox and feral cats, a total of 13 species were mapped and merged according to their IUCN Red List assessment.

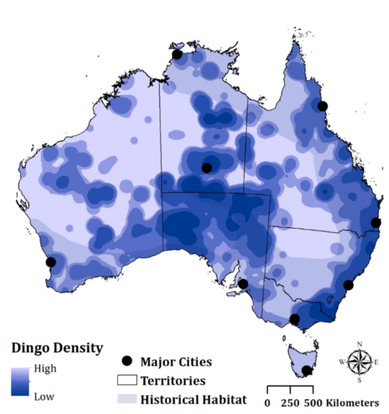
Since devils are primarily scavengers and only opportunistically hunt, it was decided that close proximity to these species would be beneficial by preventing invasive species predation.

Red List Category	Species
Critically Endangered	Carpentarian Rock Rat Mountain Pygmy Possom Woylie
Endangered	Northern Quoll Numbat Prosperine Rock Wallaby
Vulnerable	Bilby Golden Bandicoot Western Barred Bandicoot
Near Threat	Red Tailed Phascogale Spotted Tail Quoll
Least Concern	Long Nosed Bandicoot Northern Brown Bandicoot

Final Map

A weighted analysis was performed using Raster Calculator giving each factor the following weight:

- **25%** Historical Habitat
- **10%** Threatened Species
- **5%** Human Population
- **5%** Land Use
- **10%** Invasive Species Density
- **15%** Dingo Density
- **15%** National Park
- **15%** Operating Mines



Dingo Density

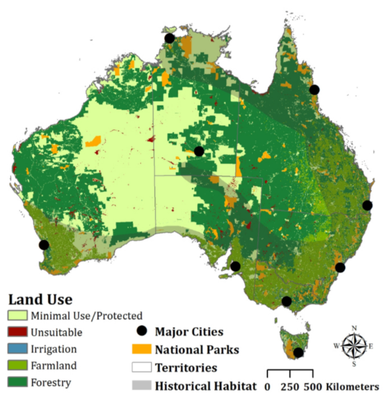
Dingo population data was acquired from the Atlas of Living Australia. Kernel Density was used and the resulting layer was reclassified.

It is unknown whether or not dingoes would prey upon devils since they do not reside in Tasmania. Therefore lower density dingo areas were considered more suitable.

Methods

Historical habitat for Tasmanian Devils in mainland Australia was Georeferenced from Rewilding Australia and applied to all maps. Prior to reclassification, Euclidean Distance was run on Threatened Species (all levels of threat were merged), Historical Habitat, and National Parks layers since close proximity to these areas would increase suitability.

Reclassification was done on each of the factors prior to Raster Calculator. Historical Habitat was weighted the highest since the devils are most likely to assimilate back into those areas without any detrimental effects on native flora and fauna. Human Population and Land Use were only weighted at 5% each since devils on Maria Island seemed to prefer habitat near humans for scavenging, but more populated urban areas would also increase their risk of being hit by a car. All other factors were more evenly weighted (10% - 15%), due to a consistency in positive or negative impact which that factor would likely have on the devil populations.



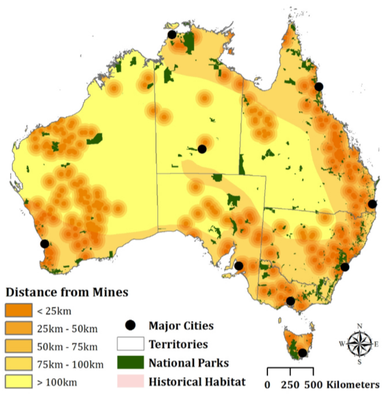
Land Use

Reintroducing devils into National Parks would allow for protection as well as monitoring. Department of Agriculture and Water Resources land use data was reclassified and combined with Protected Planet National Park data in order to determine the most suitable parks to reintroduce devils into. Higher suitability was given to areas of minimal use and park locations.

Top 3 National Park Reintroduction Sites

Reintroduction of Tasmanian Devils to National Parks is preferred to simplify management of the populations. Devils are also less likely to become roadkill while scavenging due to constant surveillance by park rangers. The practice of removing roadkill before dusk which is currently done in many areas of Tasmania , could also be implemented to further decrease this risk.

Zonal Statistics as a Table was run on the final maps weighted suitability and then joined to the National Parks layer. The top 3 parks were then chosen based on highest mean; excluding locations within Tasmania and requiring an area of greater than 150 km² to allow for sufficient habitat. All 3 top scoring National Parks, Lower Glenelg, Errk Oykangand, and Barmah are located within the Historical Habitat of the devils.



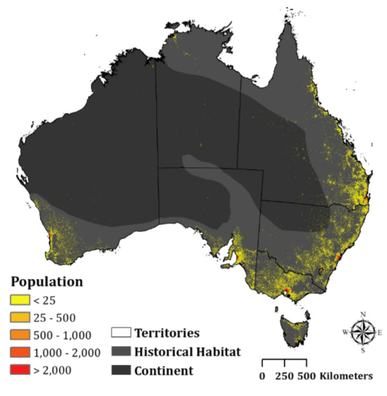
Distance from Mines

Operating mines would cause an immediate threat to devils which make their dens in a variety of paces including old burrows. Euclidean Distance was run on data acquired from Geoscience Australia.

Low suitability was given to areas <25km from mine locations, while high suitability was considered to be anything >100km from mine locations.

Conclusion

Many of the factors used in this analysis would need to be monitored once Tasmanian Devils are reintroduced to mainland Australia. For instance, it is believed that devils would suppress feral cat and red fox populations, but it is unknown if they would do so where these invasive predators are already established. Devils may also end up having a negative effect on threatened species if they begin to prey upon them instead of their normal scavenging behavior. It is always a risk to reintroduce a species after years of its absence in an ecosystem, but considering the disease which these creatures are facing in Tasmania, and the positive impact that they could have on mainland Australia's ecosystem, it may be a risk they are willing to take.



Population

Australia population data from 2011 was acquired from the Australian Bureau of Statistics. Humans can have both positive and negative effects on devils. Since devils are primarily scavengers, they tend to prefer areas near people which makes them highly susceptible to being hit by cars when consuming road kill. Therefore it was decided that lower populations would be safer and therefore more suitable.

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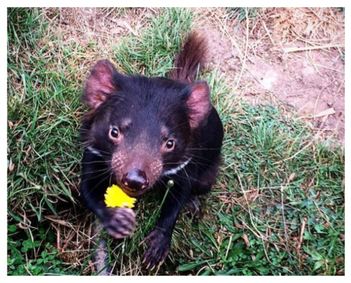

Acknowledgements

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Nancy McNamara
GIS for Conservation Medicine
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Projection: GDA_1994_Australia_Albers

Data Sources: Australian Bureau of Statistics, Protected Planet, IUCN Red List of Threatened Species, International Standards Organization, Global Administrative Areas, Department of Agriculture and Water Resources, Rewilding Australia, Geoscience Australia